

NON-PUBLIC?: N  
ACCESSION #: 8804200224

LICENSEE EVENT REPORT (LER)

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FACILITY NAME: San Onofre Nuclear Generating Station, Unit 2

DOCKET NUMBER: 05000361

TITLE: Manual Reactor Trip Due To Feedwater Isolation Valve Failing  
Closed

EVENT DATE: 12/17/87 LER #: 87-031-01 REPORT DATE: 04/14/88

OPERATING MODE: 1 POWER LEVEL: 075

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: H. E. Morgan, Station Manager TELEPHONE #: 714-368-6241

COMPONENT FAILURE DESCRIPTION:

CAUSE: D SYSTEM: SJ COMPONENT: SOL MANUFACTURER: M090

REPORTABLE TO NPRDS: Y

CAUSE: B SYSTEM: JI COMPONENT: PCV MANUFACTURER: C600

REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: At 0831 on 12/17/87, with Unit 2 at 75% power, one of two Main Feedwater Isolation Valves (MFIV) failed closed, causing both Main Feedwater Pumps to trip on high discharge pressure. Unit 2 was manually tripped in accordance with operating practice to minimize the effects of the loss of feedwater. Concurrent with the automatic initiation of the Emergency Feedwater Actuation System for Steam Generator #2 (EFAS 2) as a result of low level in Steam Generator #2, EFAS 1 (for SG#1) and EFAS 2 were manually actuated. Plant conditions were established, and recovery proceeded normally. This event had no effect on the health and safety of plant personnel or the public since all safety systems operated as designed.

The threaded conduit connection to the affected MFIV solenoid was found loose, and the cable penetration area into the conduit connector was not sealed. By one or both of these paths, water and foreign material entered the solenoid

housing and caused corrosion of the power leads and terminal block. This resulted in failure of the power lead to the MFIV solenoid and closure of the MFIV. The Maintenance procedure for reassembly of the solenoid did not provide sufficient guidance regarding the reinstallation of the conduit and sealing of the cable penetration to ensure their water tightness.

The terminal block and power leads to the affected MFIV solenoid, as well as the solenoid coil and plunger, were replaced. The threaded conduit connection

to the solenoid valve and the cable penetration area into the conduit connector were properly sealed. The Maintenance procedure which describes the overhaul of the MFIVs will be revised to adequately address properly sealing the conduit connections.

(End of Abstract)

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Plant: San Onofre Nuclear Generating Station (SONGS)

Unit: 2

Reactor Vendor: Combustion Engineering

Event Date: 12/17/87

Time: 0831

#### A. PLANT CONDITIONS AT THE TIME OF THE EVENT:

Mode: 1, Power Operation (75% power)

#### B. BACKGROUND INFORMATION:

##### 1. Main Feedwater Isolation Valves

The Main Feedwater Isolation Valves (MFIV) (EIIS Component Code ISV) function to isolate the Feedwater System (EIIS System Code SJ) from the Steam Generators (SG) (EIIS Component Code SG) upon receipt of a manual or automatic signal. Each MFIV is held in the open position by a hydraulic system which exerts pressure on the bottom of a piston actuator. For each valve to shut and perform its safety function, redundant actuation solenoid valves (EIIS Component Code ISV), whose solenoids (EIIS Component Code SOL) are powered from separate Class IE power sources (EIIS System Code EJ), open and dump hydraulic oil from the bottom of the piston actuator through two separate lines, allowing nitrogen pressure on the top of the piston actuator to close the valve.

##### 2. Steam Bypass Control System

The Steam Bypass Control System (SBCS) (EIIS System Code JI) contains four valves (EIIS Component Code PCV) which open following a turbine/reactor trip and dissipate excess energy from the steam generators directly to the main condenser (EIIS Component Code COND). This minimizes the increase in SG pressure following the trip thereby alleviating the need for the Main Steam Safety Valves (EIIS Component Code RV) to open.

### C. DESCRIPTION OF THE EVENT:

#### 1. Event:

At 0831 on 12/17/87, one of two Main Feedwater Isolation Valves (MFIV) failed closed, causing both Main Feed Pumps (MFP) to trip on high discharge pressure. Unit 2 was manually tripped in accordance with operating practice to minimize the effects of the loss of feedwater. Concurrent with the automatic initiation of the Emergency Feedwater Actuation System for SG #2 (EFAS 2) (EIIS System Code BA) as a result of low level in SG #2, both EFAS 1 (for SG #1) and EFAS 2 were manually actuated. It was noted that one SBCS valve failed to open beyond 10% during the event. Plant conditions were stabilized, and recovery proceeded normally.

#### 2. Inoperable Structures, Systems or Components that Contributed to the Event:

None

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#### 3. Sequence of Events:

##### TIME ACTION

0831 (12/17) Both Main Feed Pumps tripped on high discharge pressure when Main Feedwater Isolation Valve 2HV-4048 failed closed. Operators manually tripped the reactor. One Steam Bypass Control Valve failed to open beyond 10%.

0845 Commenced plant recovery

1322 (12/18) Completed repairs to 2HV-4048

1613 Returned Unit 2 to Power Operation

#### 4. Method of Discovery:

Control Room alarms and indications alerted the operators of the MFIV failure and the MFP trips.

#### 5. Personnel Actions and Analysis of Actions:

In accordance with operating practice, the operators manually tripped the reactor upon receipt of indication that both MFPs had tripped. The operators manually initiated EFAS 1 and EFAS 2 to assist in the mitigation of the loss of feedwater to the steam generators.

When one SBCS valve failed to open beyond 10%, the operators took manual control of the other SBCS valves to enhance system response in maintaining SG pressure within the desired band. SG pressure never reached the Main Steam Safety Valve setpoint.

The operators stabilized plant conditions utilizing the Standard Post Trip Actions and the Reactor Trip Recovery procedures. Proper operation of all EFAS components was verified.

#### 6. Safety System Responses:

The Reactor Protection System was actuated manually and operated in accordance with design.

EFAS 2 automatically actuated on low level in SG #2. EFAS 1 and EFAS 2 were concurrently manually actuated. All EFAS components operated properly.

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#### D. CAUSE OF THE EVENT:

##### 1. Immediate Cause:

The immediate cause of the event is the failure of a power lead to the train B solenoid valve for MFIV 2HV-4048, causing the hydraulic oil to be dumped from the bottom of the MFIV piston actuator and resulting in closure of the MFIV.

##### 2. Intermediate Cause:

The threaded conduit connection to the affected MFIV solenoid was found loose, and the cable penetration area into the conduit

connector was not sealed. By one or both of these paths, water and foreign material entered the solenoid housing and caused corrosion of the power leads and terminal block.

### 3. Root Cause:

The Maintenance procedure for reassembly of the solenoid housing did not provide sufficient guidance regarding the reinstallation of the conduit and cable penetration to ensure their water tightness.

## E. CORRECTIVE ACTIONS:

### 1. Corrective Actions Taken:

The terminal block and power leads to the train B solenoid valve of MFIV 2HV-4048, as well as the solenoid coil and pluger, were replaced. The threaded conduit connection to the solenoid valve and the cable penetration area into the conduit connector were properly sealed.

The terminal blocks and power leads to the other Unit 2 MFIV solenoids (and Main Feedwater Block Valves (MFBV) solenoids, which have a similar design) were inspected for corrosion and other problems. The leads into the terminal block for the train A solenoid valve for 2HV-4048 were found to be discolored and were replaced. No other problems were noted for the other solenoid valve power leads and terminal blocks.

This event has been discussed with appropriate Maintenance personnel in the Maintenance Professional Development Program.

### 2. Planned Corrective Actions:

The Maintenance procedure which describes the overhaul of the MFIVs and MFBVs will be revised to adequately address properly sealing the conduit connections.

The terminal blocks and power leads for the Unit 3 MFIV and MFBV solenoid valves will be inspected during the next outage of sufficient duration.

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As a result of this event and a recent Unit 1 DC Bus ground which was caused by water intrusion into a Turbine Plant Cooling Water Valve solenoid housing (See LER 87-018, Docket No. 50-206), the Trip

Reduction Task Force is evaluating this event and will initiate actions as necessary to address concerns regarding the protection of electrical components from water intrusion.

#### F. SAFETY SIGNIFICANCE OF THE EVENT:

This event had no effect on the health and safety of plant personnel or the public since all safety systems operated and designed. There are no reasonable or credible alternative conditions which could have increased the severity of this event.

#### G. ADDITIONAL INFORMATION:

##### 1. Component Failure Information:

The MFIVs are 20" gate valves manufactured by WKM (Cooper Industries) The valves utilize an electro-hydraulic actuator.

The solenoid (pilot) valve assembly which was affected by water intrusion in this event is a 1.5" valve manufactured by Marotta Scientific Controls, Inc., model no. MV233C and MV238C.

The SBCS valves are 12" inlet, 18" outlet, combined shutoff/pressure reducing angle valves manufactured by Control Components, Inc., model no. B36A-12-12BW-18BW-31NB42.

##### 2. Previous LERs on Similar Events:

LER 86-004 (Docket 50-361)

Unit 2 was manually tripped when the Main Feedwater Block Valve (MFBV) similar in design to the Main Feedwater Isolation Valve! closed due to failure of a coil in a solenoid operated pilot valve. The coil failure was due to moisture in-leakage into the solenoid housing caused by inadequate engagement of the conduit and the solenoid assembly. The solenoid assembly was replaced, the conduit properly engaged, and the MFBV returned to service. An external visual inspection of similar solenoid operated valves determined no similar problems; therefore, this was considered to be an isolated event and no further corrective action was taken.

##### 3. Results of NPRDS Search:

The NPRDS search resulted in four WKM valve failures in which there is a strong possibility that the cause of the failures was water intrusion into the solenoid circuitry.

The search resulted in no additional corrective actions beyond those already mentioned. (Refer to section E.)

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#### 4. Other information

##### a. MFIV Design

Each MFIV is designed to perform its safety function (i.e., close) assuming a single active component failure. The MFIV will also close if a single failure occurs in either one of the redundant solenoids. An upgraded design will replace and reconfigure the solenoid valves to prevent a single failure from causing a spurious MFIV closure which could result in a unit trip. This change is planned to be implemented during the Cycle V outages for Units 2 and 3.

##### b. SBCS Valve Failure

The failure of SBCS valve 2HV-8425 in this event was consistent with previous SBCS valve performance over the past two years. Modifications which will improve the reliability and performance of these valves are in progress and are approximately 50% complete on the total population of eight valves (Units 2 and 3). These modifications are continuing on a "one valve at a time" basis while the unit is in operation. Approximately six months is required to complete the modifications to each valve with completion of all eight valves expected by December 1989.

ATTACHMENT # 1 TO ANO # 8804200224 PAGE: 1 of 1

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H. E. MORGAN TELEPHONE  
Station Manager (714) 368-6241

April 14, 1988

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 2

Subject: Docket No. 50-361  
Supplemental Report  
Licensee Event Report No. 87-031, Revision 1  
San Onofre Nuclear Generating Station, Unit 2

Reference: Letter, Mr. H. E. MOrgan (SCE) to USNRC Document Control  
Desk, dated January 18, 1988

The referenced letter provided the required 30-day written Licensee Event Report (LER) for an occurrence involving the manual actuation of the Reactor Protection System and the manual and automatic actuations of the Emergency Feedwater Actuation System. This submittal provides additional information regarding this occurrence pursuant to 10 CFR 50.73(b)(5).

If you require any additional information, please so advise.

Sincerely,  
/s/ H E Morgan

Enclosure: LER No. 87-031, Rev. 1

cc: F. R. Huey (USNRC Senior Resident Inspector, Units 1, 2 and 3)  
J. B. Martin (Regional Administrator, USNRC Region V)  
Institute of Nuclear Power Operations (INPO)

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